

We claim:

- 1        1. A method for fabricating a tapered optical coupling into a slab waveguide  
2           comprising:
  - 3              providing a sputtering source;
  - 4              providing at least one mask between said source and said mask;
  - 5              disposing a tapered layer of material onto a substrate which includes a  
6              waveguiding layer by means of shadow deposition defined by said sputtering source  
7              and said at least one mask, said tapered layer extending in a first two dimensional  
8              plane and optically coupled to said waveguiding layer; and  
9              photolithographically defining a second taper in said tapered layer, said second  
10             taper extending in a second two dimensional plane intersecting said first two  
11             dimensional plane.
- 1        2. The method of claim 1 where photolithographically defining a second taper in  
2           said tapered layer defines said second two dimensional plane so as to  
3           perpendicularly intersect said first two dimensional plane.
- 1        3. The method of claim 1 further comprising photolithographically defining a slab  
2           waveguide in said waveguiding layer simultaneously with photolithographically  
3           defining a second taper in said tapered layer.

1       4. The method of claim 3 further comprising coupling said slab waveguide to a  
2       photonic crystal.

1       5. The method of claim 4 where coupling said slab waveguide to said photonic  
2       crystal comprises forming said slab waveguide integrally with said photonic crystal.

1       6. The method of claim 1 where disposing said tapered layer of material onto said  
2       substrate comprises disposing said tapered layer by means of shadow deposition  
3       defined by said sputtering source and said at least two masks.

1       7. The method of claim 1 where disposing said tapered layer of material onto said  
2       substrate comprises disposing polycrystalline silicon.

1       8. The method of claim 1 where disposing said tapered layer of material onto said  
2       substrate comprises disposing a material with an approximately matching refractive  
3       index to said waveguiding layer.

1       9. The method of claim 1 further comprising repeating said method on an opposing  
2       side of said substrate to form another tapered optical coupling on said opposing side  
3       aligned with said tapered optical coupling.

1       10.     The method of claim 1 further comprising first forming a tapered substrate  
2     by means of shadow deposition and then forming said tapered optical coupling on  
3     said tapered substrate to obtain a fully flared, funnel-shaped, optical coupling.

1       11     A tapered optical coupling comprising:  
2        a substrate;  
3        a slab waveguide on or in said substrate; and  
4        a funnel-shaped termination on or in said substrate and optically coupled to said  
5     slab waveguide.

1       12.     The apparatus of claim 11 further comprising a photonic crystal and where  
2     said photonic crystal is optically coupled to said slab waveguide.

1       13.     The apparatus of claim 12 where said slab waveguide is integral with said  
2     photonic crystal.

1       14.     The apparatus of claim 11 further comprising an optic fiber and where said  
2     funnel-shaped termination is optically coupled to said optic fiber.

1       15.     The apparatus of claim 11 where said funnel-shaped termination is formed  
2     by shadow deposition.

1       16.       The apparatus of claim 11 where said funnel-shaped termination is  
2       composed of material having an index of refraction approximately matching said slab  
3       waveguide.

1       17.       The apparatus of claim 16 where said funnel-shaped termination is  
2       composed of polycrystalline silicon.

1       18.       The apparatus of claim 17 where said slab waveguide is composed of  
2       GaAs.

1       19.       The apparatus of claim 11 where said funnel-shaped termination is a half-  
2       funnel shape.

1       20.       The apparatus of claim 11 where said funnel-shaped termination is a full-  
2       funnel shape.

1       21.       The apparatus of claim 11 where said funnel-shaped termination  
2       comprises a surface for optical coupling inclined with respect to said substrate.